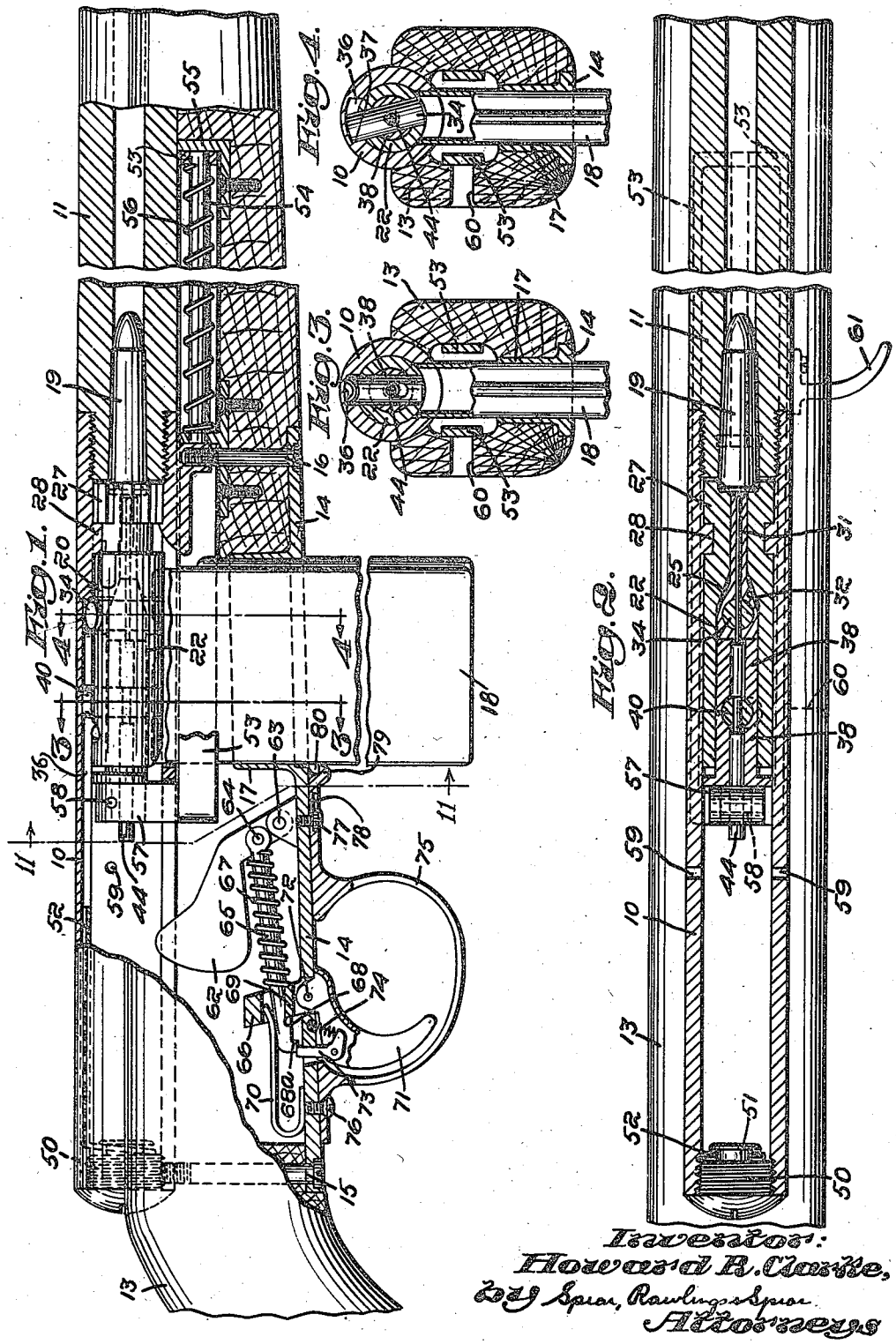
June 4, 1946. H. R. CLARKE 2,401,616

FIREARM

Filed Feb. 2, 1944 4 Sheets-Sheet 1



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FIREARM

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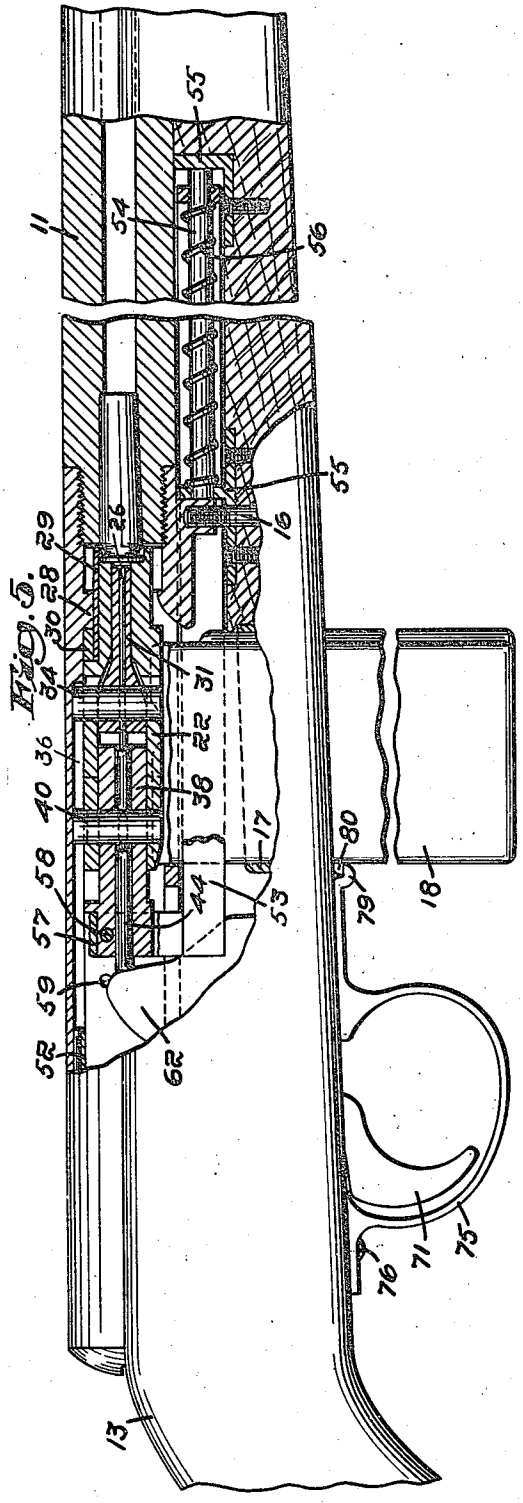

Fig. 5.

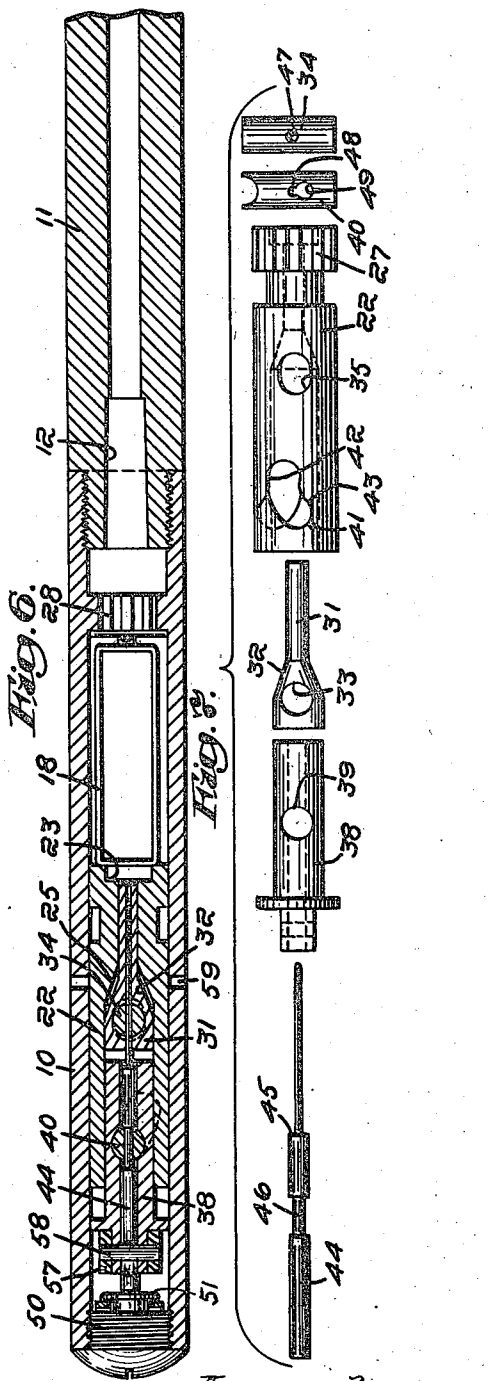

Fig. 6.

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FIREARM

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Fig. 8.

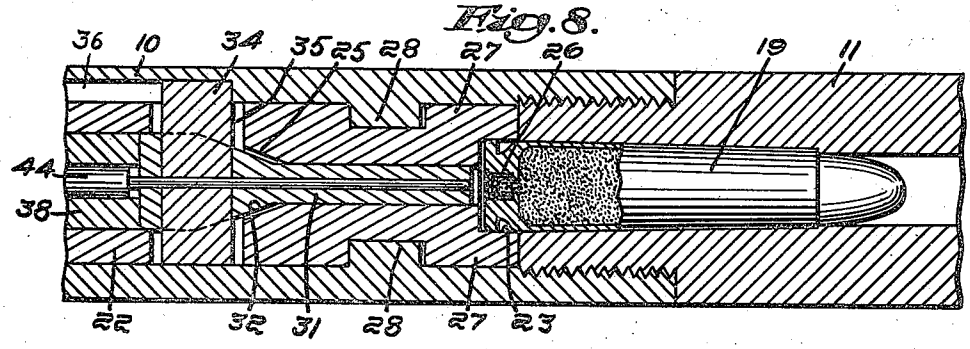


Fig. 9.

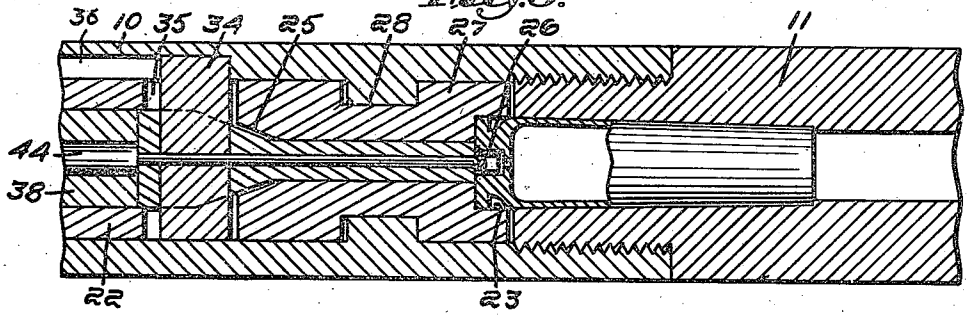
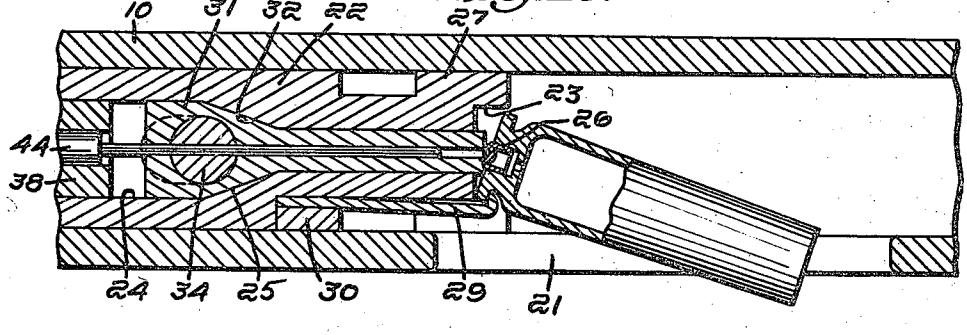


Fig. 10.



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FIREARM

Filed Feb. 2, 1944 4 Sheets-Sheet 4

Fig. 11.

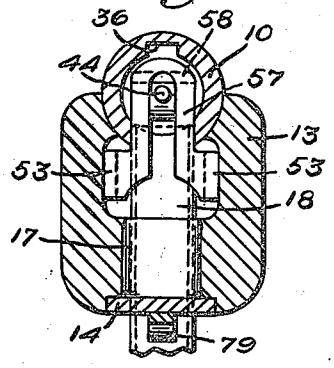


Fig. 12.

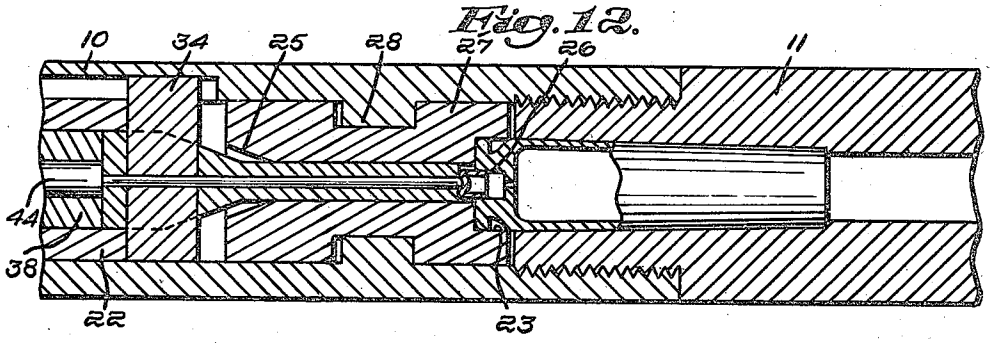
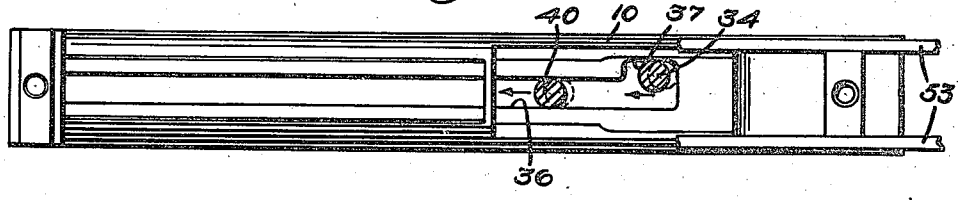


Fig. 13.



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Patented June 4, 1946

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UNITED STATES PATENT OFFICE

2,401,616

FIREARM

Howard R. Clarke, Newton Highlands, Mass.

Application February 2, 1944, Serial No. 520,735

11 Claims. (Cl. 42—3)

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My present invention relates to automatic or semi-automatic firearms of the type in which a piston-like action of the primer of a fired cartridge is utilized to unlock the bolt.

Various attempts have been made to utilize the forces developed by and exerted on a fired cartridge to unlock a bolt to provide the basis of automatic or semi-automatic operation. These have been complicated and heavy in construction and unsatisfactory and unreliable in operation.

In accordance with a preferred embodiment of my present invention, I provide a firearm, the receiver of which slidably supports a bolt to reciprocate out of and into a closed position to extract and eject a fired cartridge, re-cock the firing mechanism and to seat another cartridge in the chamber of the barrel. The bolt comprises a shell having an axial passage and carries a cartridge engaging extractor. Rearwardly of its cartridge contacting front face, the bolt shell has a plurality of lugs spaced to pass between lugs on the receiver as the bolt moves into or out of its cartridge seating position and to engage therewith when the bolt shell is seated and partially rotated to lock the bolt to the receiver.

An actuator slidably supported in the receiver has a cam connection with the bolt shell effective to rotate the bolt shell into its unlocked position when the actuator moves rearwardly relative thereto and to rotate the bolt shell into its locked position when the actuator moves forwardly relative thereto. The actuator is controlled by resilient means to oppose its unlocking movement and the opening of the bolt and to urge the bolt towards its seated position and to cause locking movement of the actuator when the bolt shell is seated.

The front part of the axial passage of the bolt shell slidably supports a tappet which is in contact with the actuator and has a pin or the like extending through a slot in the shell of sufficient length to permit limited relative movement between the bolt shell and the tappet to permit the tappet to be driven rearwardly from a position in which it is actuated by the primer to drive the actuator through a working stroke adequate at least to cause unlocking of the bolt. The receiver is formed with a groove to receive the pin to hold the bolt shell against rotation except when seated.

It will be helpful, in understanding my invention, to consider certain factors at this time relating to the firing of a cartridge and the effect of gas pressure thereon. It will also be helpful to bear in mind that the firing of a cartridge involves first the explosion of the primer which is

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followed by the ignition of the cartridge charge. When the primer is exploded, its explosion may be attended by movement of it relative to the cartridge case. Firing of the main charge by the primer results in gas pressure effective first to drive the cartridge case rearwardly to take up head space and then to drive the primer rearwardly relative to the cartridge case. In accordance with my invention, it is the piston-like action of the primer under the influence of the gas pressure of a fired charge that I use to effect the unlocking of the bolt.

I have stated that the lugs on the bolt shell and on the receiver serve to lock the bolt to the receiver. In practice, head space is always provided to ensure the operation of the bolt under all conditions. Head space is conventionally closely limited to provide a certain limited space between the front face of a closed bolt and the rear face of a seated cartridge. Head space, however, may also be represented, at least in part, by a space between the lugs when the bolt is closed. When a cartridge is fired, the gas pressure in the barrel acts on the cartridge case to expand it against the chamber and to drive it rearwardly and where space exists between the receiver and bolt lugs, the gas pressure is also effective to drive the bolt, within the limits of the head space, until arrested by the receiver lugs.

Due to variations in violence of primers of conventional cartridges, some of the primers, when fired, move rearwardly relative to the cartridge case a limited distance before the main charge is fired. While primers are conventionally countersunk with respect to the rear face of the cartridge, the possibility of their movement must be considered in firearms in accordance with my invention. When the main charge of a cartridge is fired, the resulting gas pressure is effective to drive the primer rearwardly relative to the cartridge case. The gas pressure in the barrel is substantial, but decreases as the bullet approaches the muzzle of the barrel. When the bullet leaves the barrel, the pressure drops off sharply. The pressure remaining momentarily in the barrel after the bullet leaves it, may be termed "residual pressure."

The timing of the relation between the unlocking of the bolt and the gas pressure in the barrel is of prime importance in providing safe, positive and reliable operation of firearms in accordance with my invention. To meet these requirements, I use the positive action of the primer, when driven relative to the cartridge case by the gas pressure of a fired charge, to give the tappet a

definite uninterrupted stroke. This stroke is sufficient to cause the actuator to be effective, through the cam connection, to rotate the bolt into its unlocked position and start its movement towards its open position at a time, preferably, when only residual pressure is available to ensure completion of the movement of the bolt into its open position.

I accomplish this result by forming the groove in the receiver that guides the pin carried by the tappet so that the front end of the tappet, when the bolt is seated and locked, is spaced substantially flush with the front face of the bolt when the bolt and receiver lugs are in engagement. By this arrangement, movement, within head space limits, of the cartridge case, the bolt, or both when a cartridge is fired, can have no effect on the tappet since the front end of the tappet is positioned rearwardly of the front face of the bolt unless and until the bolt lugs are in engagement with the receiver lugs. Because of head space, and because the forward movement of the tappet is limited, any movement of the primer, when it is fired, can have no effect on the tappet. Since my invention provides for a definite uninterrupted tappet stroke, it is only necessary to provide a cam connection between the actuator and the bolt shell to effect the unlocking of the bolt at the right time in relation to the gas pressure in the barrel.

My invention also provides novel ejector means to eject an extracted cartridge. As the bolt reaches its open position, the pin carried by the tappet engages a stop, preferably carried by the stop which limits rearward movement of the bolt, to cause the tappet to be driven forwardly relative to the bolt shell to protrude beyond its front face thereby to eject the extracted cartridge. As the tappet strikes the primer, it tends to reseat it thereby ensuring against the primer being dislodged and dropping into the mechanism. The forward end of the tappet is preferably larger than the primer and therefore cannot strike the countersunk primer of an unfired cartridge and, as the bolt shell is again seated, the tappet is held by the pin guiding groove so that the bolt shell moves forward relative thereto. When the bolt shell is seated, the actuator under the bolt actuating action of the resilient means, rotates the bolt shell into its locked position and returns to its normal position in contact with the tappet.

In accordance with my invention, I am able to provide automatic firearms of light weight, simple and inexpensive construction that combine ease of assembly and service with safety and reliability in use. The lightness of the parts make possible a rapid acceleration and deceleration of the mechanism that is easy to control to ensure accurate and safe operation.

This introduction of the firearm used to illustrate my invention makes it apparent that a characteristic feature of my invention is that the tappet is positioned relative to the receiver and independently of the bolt shell regardless of the specific construction of the bolt and the receiver.

In the accompanying drawings I have shown, as an embodiment of my invention, a firearm of the carbine type from which these and other of its novel features and advantages will be readily apparent.

In the drawings:

Fig. 1 is a fragmentary partial section showing a firearm in accordance with my invention ready to fire.

Fig. 2 is a plan section through the barrel and receiver with the parts in the positions shown in Fig. 1.

Fig. 3 is a cross section along the lines **3—3** of Fig. 1.

Fig. 4 is a similar view along the lines **4—4** of Fig. 1.

Fig. 5 is a view similar to Fig. 1, showing the position of the parts immediately after the gun is fired and the bolt is unlocked.

Fig. 6 is a plan section through the receiver and the barrel showing the position of the parts when the bolt is substantially in its open position.

Fig. 7 is an exploded view of the bolt parts.

Fig. 8 shows in an enlarged fragmentary view the relation of the bolt parts to a seated cartridge before firing.

Fig. 9 is a similar view showing the position of the bolt parts to a seated cartridge after firing but before the gas pressure has acted upon the primer.

Fig. 10 is a similar view showing the position of the bolt parts when ejecting an extracted cartridge and Fig. 11 is a section along the lines **11—11** of Fig. 1. Fig. 12 is a view similar to Fig. 9 showing the position of the bolt parts as the tappet is driven rearwardly through its limited stroke by the primer to cause the actuator to effect the unlocking of the bolt shell, and Fig. 13 is a bottom view of the receiver showing the guide groove and the position of the pins in section when the bolt parts are positioned as shown in Fig. 12 with their position in Fig. 9 being indicated by dotted lines.

General construction

I have shown my invention as embodied in a firearm of the carbine type and I have omitted sights, safety and other details of construction to simplify the drawings.

At **10**, I have shown a receiver to which is threaded a barrel **11** having a chamber **12**. A stock **13** is suitably inlet for the receiver **10** and the barrel **11** and is clamped between the receiver **10** and the plate **14** by screws **15** and **16** which extend through the plate **14** and the stock **13** and are threaded into the receiver **10**. The stock **13** is formed to house the trigger controlled firing mechanism, later to be described, which and the support **17** for the clip **18** holding cartridges **19**, are carried by the plate **14**. The fore part of the stock **13** is also formed to house the spring powered bolt return means also later to be described, which means also serve to oppose the unlocking of the bolt and its movement into its open position.

I have indicated generally at **20**, a bolt slidably and rotatably supported in the receiver **10** to move, when the gun is fired, from a closed and seated position (Figs. 1 and 2) into and out of an open position (Fig. 6), to extract and eject a cartridge case through the slot **21**, cock the firing mechanism, and to pick up another cartridge from the clip **18** and to seat it in the chamber **12** of the barrel **11**.

The bolt and receiver construction

In accordance with my invention, the bolt **20** consists of a bolt shell **22** which and the other bolt parts may be seen most clearly in Fig. 7. The bolt shell **22** has a countersunk cartridge engaging front face **23** and is formed with an axial passage **24** reduced as at **25** to establish

a seat and a front portion of slightly greater diameter than that of the primers 26 of the cartridges 19. Rearwardly of its cartridge engaging face 23, the bolt shell 22 has a plurality of lugs 27 spaced to pass between lugs 28 on the receiver as the bolt shell moves into and out of its seated position and to aline therewith when the seated bolt shell is partially rotated thereby to establish a locked bolt position. (See Figs. 5 and 6.) The bolt shell 22 is formed to receive an extractor 29 which is detachably locked in place by a friction plug 30.

Within the bolt shell, I slidably mount a tappet 31 which is reduced in diameter as at 32 to establish a shoulder, engageable with the seat 25, and a front part to slidably fit the front portion of the bolt shell passage 24. The tappet 31 is axially alined with the primer 26 of a cartridge seated in the chambered barrel and is adapted to be driven rearwardly thereby when the primer is unseated and driven rearwardly relative to its case by the gas pressure of the fired charge.

The tappet 31 has a transverse passage 33 to slidably receive a guide pin 34 which extends through a slot 35 in the bolt shell 22 and into a guide groove 36 in the receiver 10. The guide groove 36 serves to hold the bolt shell 22 against rotation when it is unlocked, that is, when it is positioned so that its lugs 27 may pass between the receiver lugs 28 and, at its front end, extends laterally as at 37, to permit rotation of the bolt shell 22 when seated. The slot 35 in the bolt shell 22 limits relative movement between the bolt shell 22 and the tappet 31 so that the tappet may have an extreme forward position in which its shoulder 32 is in engagement with the seat 25 and its front end protrudes beyond the front face 23 of the bolt shell (Fig. 10) and a rearward position in which it is set back by the piston-like action of the primer to have a working stroke against the actuator insufficient to permit the primer 26 to be entirely unseated (Fig. 5).

An actuator 38 is slidably housed within the rear part of bolt shell passage 24 and is of sufficient length to protrude beyond the rear face of the bolt shell 22 when it is seated against the rear face of the tappet 31. The protruding rear end of the actuator 38 is connected to and slidably guided by the bolt return means. I form the actuator with a transversely disposed passage 39 to receive a cam pin 40 extending through a cam slot 41 in the bolt shell 22. Preferably, the end of the cam pin 40 also extends into the guide groove 36 in the receiver 10. On rearward movement of the actuator 38 relative to the bolt shell 22, the cam connection is effective to rotate the bolt shell 22 into its unlocked position and, on forward movement of the actuator 34 relative to the bolt shell 22 under the influence of the bolt return means, it is effective to rotate the bolt into its locked position. I form the cam slot 41 to establish a straight front portion 42 and a curved cam portion 43 (Fig. 7) so that initial rearward movement of the actuator is ineffective to rotate the bolt shell 22 thereby to provide a delay in unlocking the bolt shell 22 in desired relation to the gas pressure of a fired cartridge. On forward movement of the actuator 38, the guide groove 36 prevents the cam portion 43 from being effective to rotate the bolt shell 22 until it is seated and then the actuator 38 moves relative to the bolt shell 22 to re-engage the tappet 31.

The tappet 31 and the actuator 38, as shown in Figs. 6 and 7, are each formed with axial passages to slidably receive the firing pin 44, with the passage in the tappet 31 being of smaller diameter than that through the actuator 38. The front portion of the firing pin 44 is of reduced diameter and the thus established shoulder 45 is engageable with the rear face of the tappet 31 to limit the forward stroke of the firing pin. Intermediate the rear portion of the firing pin 44, its diameter is reduced as at 46. The guide pin 34 and the cam pin 40 have transverse passages 47 and 48 respectively of the same diameter as the reduced portions of the firing pin 44 and when these register with the axial passages through the tappet and actuator, the bolt is correctly assembled. The passage 48 of the cam pin 40 communicates with an enlarged passage 49 of sufficiently large size to receive the largest portion of the firing pin so that the bolt may be easily assembled by placing the tappet 31 and actuator 38 within the bolt shell 22 with the passages 47 and 49 of the guide pin and cam pin respectively in alinement with axial passages through the tappet and actuator. The firing pin 44 may then be inserted until its reduced portion 46 is in registry with the passage 49 of the cam pin 40. The cam pin 40 may then be shifted laterally of the bolt shell 22 so that the portion 46 enters the passage 48. The bolt is then assembled and the axial movement of the firing pin is limited, relative to the actuator, to establish a firing stroke.

As shown in Figs. 1 and 2, the rear end of the receiver may be threaded to receive a cap 50 which is removable to permit the bolt 20 to be removed when disconnected from the bolt return means. In practice, the guide groove 36 extends to the rear end of the receiver 10 so that the protruding pin ends of the assembled bolt may be entered therein. The cap 50 has a boss 51 serving as a stop to limit the rearward movement of the bolt 20 to define its open position and is recessed to accommodate the rear end of the firing pin 44. Centered by the boss 51 is a resilient stop 52 extending into the guide groove 36 to be engaged by the guide pin 34 as the bolt approaches the open position. The portion of the stop 52 in the guide groove 36 is convex in cross section and the end of the cam pin 40 is concave to straddle the stop 52 as shown in Fig. 3.

The bolt return means

The bolt return means (Figs. 1 and 5) consists of a forked arm 53 in parallel with the axis of the bolt 20 and slidably supported at its front end on a guide rod 54 in the fore stock held in the supports 55. The compression spring 56 is supported on the guide rod 54 and seated between the front end of the forked arm 53 and one of the supports 55. The arms 53 extend rearwardly and are spaced apart to straddle the magazine 18. The arms 53 terminate in an upwardly disposed loop portion 57 fitting the end of the actuator 38 and locked thereto as by the pin 58. The receiver 10 has transversely alined holes 59 by which the pin 58 may be driven out when in alinement therewith. A cover, not shown, serves to prevent ingress of dirt into the receiver 10 through the holes 59.

One side of the fore stock has a slot 60 (Figs. 2, 3, and 4) of substantially the length of the stroke of the bolt 20 and this is closed against the entrance of dirt to the return means by one of the arms 53 and to this I attach a charging handle 61 protruding outwardly for manual engagement.

The firing mechanism

Where semi-automatic operation is desired, firing mechanism in accordance with my invention as may be seen in Fig. 1 consists of a hammer 62 pivotally mounted as at 63 to the plate 14 and pivotally connected to it as at 64 is an actuating rod 65 slidably guided in a block 66. The rod 65 supports a firing spring 67 seated between the block 66 and the end of the rod 65 connected to the hammer 62. The rod 65 is notched as at 68 to provide a sear engageable with the surface 69 of the block 66 against which the rear end of the rod 65 is pressed by the spring 70.

Trigger 71 is pivoted to the plate 14 at 72 and is formed with a pocket in which a release pawl 73 is pivotally mounted. The pawl 73 extends through a slot in the plate 14 to engage with the end portion 68a of the rod 65 so that when the trigger is pulled, the rod 65 is raised to disengage from the surface 69 so that the spring 67 is operative to drive the hammer 62 against the rear end of the firing pin 44. I provide a spring 74 seated between the plate 14 and the opposite end of the pawl 73 yieldably urging the pawl 73 into the position shown in Fig. 1.

By this construction, the pawl 73 yields, if the trigger 71 is not released, when the rod 65 is forced rearwardly as the hammer is forced back by the bolt 20 as it moves into its open position, and the sear connection becomes operative and cannot be released until the trigger 71 is released thereby permitting the pawl 73 to again be positioned to raise the end of the rod 65.

I attach the rear end of the trigger guard 75 to the plate 14 by a screw 76 and at its front end, the trigger guard is slotted as at 72 to receive the screw 77. At 79, I have shown the trigger guard 75 as formed with a latch engageable with the catch 80 on the cartridge clip 18 by which the clip is locked in place. Due to the resilience of the trigger guard 75 and to the fact that it is slidably connected to the plate 14 at its front end, the trigger guard may be squeezed to provide a convenient and easily operated release to permit a clip 18 to be removed and replaced.

Operation

The operation of a gun, in accordance with my invention, may be most readily appreciated by initial reference to Fig. 8 in which I have shown the bolt 20 in its seated and locked position with a cartridge 19 seated in the chamber of the barrel 11.

Due to the fact that head space is always provided to ensure proper bolt operation under all conditions, there is space between the front face of the bolt shell 22 and the rear face of a seated cartridge 19. Head space may, however, be present, at least in part, between the receiver lugs 28 and bolt shell lugs 27 and for that reason I have shown in Fig. 8 some space both between the bolt shell lugs 28 and the rear face of the cartridge 19 and between the bolt shell lugs 27 and receiver lugs 28.

It will be understood that when a cartridge primer 26 is exploded, it may move rearwardly relative to the cartridge case, but its action is uncertain as the violence of primers varies. After the primer 26 explodes, the main charge of the cartridge 19 is ignited creating high gas pressure in the barrel 11. The gas pressure acts against the cartridge case to cause it to swell against the chamber, to stretch, and to force the cartridge case rearwardly. This action takes up head space and, unless the lugs 27, 28 are in engagement, it forces the bolt shell 22 rearwardly until arrested by lug engagement.

The gas pressure is then effective to drive the primer 26 rearwardly relative to the cartridge case and, as this movement of the primer is definite and positive, I use it to effect the unlocking of the bolt shell 22 and the commencement of its movement towards its open position.

To avoid the initial action of the primer, when it is exploded and the movement of the cartridge case, the bolt shell or both, within head space limits, from causing movement of the tappet 31, I use the guide groove portion 37 to limit the forward position of the tappet 31 so that its forward end is substantially flush with the front face 23 of the bolt shell 22 when the lugs are in engagement. By this arrangement, should the lugs not be in engagement, the front end of the tappet is set back with reference to the front face of the bolt shell so that it is not actuated by movement of the bolt within head space limits. At this point, it should be mentioned that if the tappet 31 were affected by the initial action of the primer or by movement of the cartridge case or bolt shell within head space limits, it would be given an interrupted stroke inadequate to cause reliable automatic or semi-automatic operation.

The primers 26 of cartridges are conventionally countersunk and due to this and the space ensured between the tappet 31 and the primer 26 by positioning the tappet 31 with respect to the receiver 10, any initial action of the primer 26 does not contact the tappet 31.

Movement of the cartridge case, the bolt shell, or both, within head space limits, ensures that movement of the primer 26 under the influence of the gas pressure of a fired charge is effective to impart to the tappet 31 an uninterrupted stroke against the actuator 38. In Fig. 9, I have shown the primer fired and all head space taken up so that movement of the primer 26 by the gas pressure of a fired cartridge will impart such a stroke to the tappet 31. In Fig. 12 I have shown the tappet 31 driven by the primer through the limit of its stroke. The pin 34 is now out of contact with the shoulder established by the front edge of the groove 37 and as the actuator 38 continues its travel, it causes the bolt shell 22 to rotate through its cam connection therewith, the pin 34 is positioned in alinement with the groove 36. In Fig. 13, I have shown the grooves 36 and 37. In Fig. 13, the pins 34 and 48 are sectioned to indicate their position in Fig. 12. Their position shown in Fig. 9 is indicated by dotted lines and their general path is suggested by arrows.

The tappet stroke against the actuator 38, limited by the slot 35 in the bolt shell 22, drives the actuator rearwardly as shown in Fig. 5. Under this action, the actuator 38 moves rearwardly relative to the bolt shell 22 and then cams it into its unlocked position and is effective at least to start its movement towards its open position. Because of the delayed opening of the bolt shell 22, only residual pressure in the barrel is exerted on the unlocked bolt shell 22 and this is effective to ensure the completion of the movement of the bolt into its open position.

As the bolt approaches its open position, the resilient stop 52 is engaged by the guide pin 34 so that further movement of the bolt shell 22 results in the tappet 31 occupying its extreme forward position in which it protrudes beyond the front face of the bolt shell 22. In this position,

it strikes the primer 26 of an extracted cartridge and functions as an ejector. (See Fig. 10.) Because the front end of the tappet is of greater diameter than the primer, it cannot strike the primer of an unfired cartridge.

The resilient stop 52 is operative slightly in advance of the contact of the actuator 38 with the boss 51. In Fig. 6, I have shown this relation as exaggerated. Movement of the bolt 20 towards its open position is also opposed by the bolt return means and by the firing mechanism which it recocks.

The bolt 20 is returned from its open position by the return means to pick up another cartridge 19 from the clip 18 and seat it in the chamber 12 of the barrel 11. As the bolt shell 22 is held against rotation until it is seated, the action of the bolt return means on the actuator 38 is ineffective to rotate the bolt shell 22. When the bolt shell 22 is seated, the cam connection is then operative to rotate it into its locked position and then to permit the actuator 38 to move relative to the bolt shell 22 into contact with the tappet 31. As the axial movement of the firing pin 44 is limited relative to the actuator 38, it is impossible for the firing pin 44 to be in operative relation to a cartridge until the bolt is in its locked position thereby ensuring safety in operation.

Conclusion

In the foregoing, I have described a firearm in accordance with my invention which has been successfully operated and its success is due to the novel features discussed in connection with it. While the description has been of only one embodiment of my invention, it will be apparent from it that my invention provides firearms inexpensive and simple to manufacture, safe and reliable in use, and easy to repair and service. Contributing to this result are the many features that I have discussed and particularly to the fact that the tappet is positioned positively relative to the receiver and independent of the bolt shell. In addition, attention is directed to the fact that the bolt shell 22, the tappet 31, and the actuator 38 are light in weight. This makes possible a rapid acceleration and deceleration of the parts that may be positively and accurately controlled to provide safe, efficient, and reliable operation.

What I therefore claim and desire to secure by Letters Patent is:

1. In a firearm for use with a cartridge having a centrally disposed primer, a receiver, a chambered barrel carried by said receiver, a bolt comprising a bolt shell slidably and rotatably carried by said receiver to reciprocate between a cartridge seating position and an open position, said bolt and chamber being proportioned to establish head space between said bolt and a seated cartridge when said bolt is in said cartridge seating position, an actuator and a tappet slidably supported axially of said bolt shell for contact with each other, means to hold said actuator against rotation, said bolt shell and said receiver each including engageable lugs which, when said bolt shell is seated and partially rotated, establish a locked bolt position and limit rearward movement of said bolt shell on the firing of a cartridge when at least a part of the head space is represented by space between said lugs, yieldable means urging said actuator against said tappet and opposing movement of said actuator by said tappet, a cam connection between said actuator and said bolt shell to urge said bolt shell into its unlocked and open positions when said actuator is driven by said tappet and to urge said bolt shell into its closed and locked positions when said actuator is driven by said yieldable means, a pin and slot connection between said tappet and said bolt shell limiting relative movement therebetween to provide an operative tappet stroke against said actuator and to limit the movement of the primer, and said receiver having a groove to receive one end of the pin of said pin and slot connection, said groove including a portion disposed in parallel with the axis of said barrel to hold said bolt shell against rotation and a portion disposed at right angles thereto to permit limited partial rotation of said bolt shell when seated, said last-named portion being of sufficient width to permit limited movement of said tappet therein and limiting the forward position of said tappet when said bolt is seated and locked to ensure a predetermined relation of the tappet to the primer of a seated cartridge regardless of whether head space is represented by space between said lugs, between said bolt and said cartridge or both thereby to ensure that said tappet is given an uninterrupted stroke by the gas pressure of a fired cartridge acting only through the movement of the primer.

2. In a firearm for use with a cartridge having a centrally disposed primer, a receiver, a chambered barrel carried by said receiver, a bolt comprising a bolt shell slidably and rotatably carried by said receiver to reciprocate between a cartridge seating position and an open position, an actuator and a tappet slidably supported axially of said bolt shell for contact with each other and for engagement of said tappet by the primer and actuation by its piston-like action when the cartridge is fired, means to hold said actuator against rotation, said bolt shell and said receiver each including lugs which, when said bolt shell is seated and partially rotated, engage and establish a locked bolt position, yieldable means urging said actuator against said tappet and opposing movement of said actuator by said tappet, a cam connection between said actuator and said bolt shell to urge said bolt shell into its unlocked and open positions when said actuator is driven by said tappet and to urge said bolt shell into its closed and locked positions when said actuator is driven by said yieldable means, a pin and slot connection between said tappet and said bolt shell limiting relative movement therebetween to provide an operative tappet stroke against said actuator and to limit the movement of the primer, and said receiver having a guide groove in parallel with the axis of the barrel to receive one end of the pin of said pin and slot connection to hold said bolt shell against rotation as it reciprocates and a pin accommodating groove disposed at right angles thereto to permit partial rotation of said bolt shell when seated to establish a shoulder in said receiver locating the forward position of said tappet independently of said bolt shell when said bolt is seated and locked and to permit the operative stroke of said tappet.

3. The firearm of claim 2, in which a firing pin is supported axially of the tappet and actuator and is anchored to the actuator for limited movement relative thereto, the cam connection comprises a cam pin carried by the actuator and the bolt shell has a cam slot through which the cam pin extends, the front portion of the cam slot extends in parallel with the bolt axis, and the tappet and the actuator are in engagement

only when the cam pin is in the front portion of its slot so that as the bolt moves under the influence of the yieldable means the tappet and actuator are spaced apart and the firing pin is inoperatively positioned except when the bolt shell is seated and locked.

4. The firearm of claim 2, in which the cam connection comprises a cam pin carried by the actuator and the bolt shell has a pair of oppositely disposed cam slots through which the cam pin extends, the pin and slot connection comprises a pin carried by the tappet and the bolt shell has a pair of oppositely disposed slots through which the tappet pin extends, and one end of each of the pins is entrant of the guide slot in the receiver.

5. In a firearm for use with a cartridge having a centrally disposed primer, a receiver, a chambered barrel carried by said receiver, a bolt comprising a bolt shell slidably and rotatably carried by said receiver to reciprocate between a cartridge seating position and an open position, an actuator and a tappet slidably supported axially of said bolt shell for contact with each other and for engagement of said tappet by the primer and actuation by its piston-like action when the cartridge is fired, means to hold said actuator against rotation, said bolt shell and said receiver each including lugs which, when said bolt shell is seated and partially rotated, engage and establish a locked bolt position, yieldable means urging said actuator against said tappet and opposing movement of said actuator by said tappet, a cam connection between said actuator and said bolt shell to urge said bolt shell into its unlocked and open positions when said actuator is driven by said tappet and to urge said bolt shell into its closed and locked positions when said actuator is driven by said yieldable means, said bolt shell having a slot, and a pin carried by said tappet and extending through said slot to limit relative movement between said bolt shell and said tappet to provide an operative tappet stroke against said actuator to limit the movement of the primer, and to permit the front end of said tappet to have an ejecting position in which it protrudes a predetermined distance beyond the front face of said bolt shell, and said receiver having a guide groove in parallel with the axis of the barrel to receive one end of the tappet pin to hold said bolt shell against rotation as it reciprocates and a pin accommodating groove disposed at right angles thereto to permit partial rotation of said bolt shell when seated, to establish a shoulder in said receiver locating the forward position of said tappet independently of said bolt shell when said bolt is seated and locked, and to permit said tappet stroke, and stop means positioned in the rear end of said receiver and extending forwardly in said guide slot to engage with said pin to effect its ejecting position as said bolt approaches its open position.

6. The firearm of claim 5, in which the stop means is resilient.

7. The firearm of claim 5 in which the cam connection comprises a cam pin carried by the actuator and the bolt shell has a cam slot through which the cam pin extends into the guide groove, and the groove entering end of the cam pin is formed to straddle the portion of the stop means that extends forwardly in the guide groove.

8. A bolt for a firearm comprising a firing pin, the rear part of which has a portion of reduced diameter, a bolt shell having a slot adjacent its front end and a cam shaped slot spaced rearwardly therefrom, an actuator and a tappet to be inserted into and slidably supported by said bolt shell, said actuator and said tappet each having an axial passage for said firing pin and a transverse bore intersecting said passage, an assembly pin insertable through said first slot and through the transverse bore of said tappet, and a second assembly pin insertable through said cam shaped slot and through the transverse bore of said actuator, said assembly pins each having a transverse bore to receive said firing pin when alined with said passages, the transverse bore through said second assembly pin being of keyhole shape, the larger part of which registers with the passage in said actuator before said second pin is fully inserted to receive the rear end of said firing pin and the smaller part of which receives the portion of said firing pin which is of reduced diameter when said second assembly pin is fully inserted thereby to lock said pin, said portion of said firing pin which is of reduced diameter being of greater length than the diameter of said second assembly pin.

9. A bolt for a firearm comprising a firing pin, the front part of which is of lesser diameter than its rear part to establish an intermediate shoulder and the rear part of which has a portion of reduced diameter, a bolt shell having a slot adjacent its front end and a cam shaped slot spaced rearwardly therefrom, an actuator and a tappet to be inserted into and slidably supported by said bolt shell, said actuator and said tappet each having an axial passage for said firing pin respectively of the diameter of the rear and front parts of said firing pin so that the rear face of said tappet constitutes a stop limiting the forward position of said firing pin, and a transverse bore intersecting said passage, an assembly pin insertable through said first slot and through the transverse bore of said tappet, and a second assembly pin insertable through said cam shaped slot and through the transverse bore of said actuator, said assembly pins each having a transverse bore to receive said firing pin when alined with said passages, the transverse bore through said second assembly pin being of keyhole shape, the larger part of which registers with the passage in said actuator before said second pin is fully inserted to receive the rear end of said firing pin and the smaller part of which receives the portion of said firing pin which is of reduced diameter when said second assembly pin is fully inserted thereby to lock said pin, said portion of said firing pin which is of reduced diameter being of greater length than the diameter of said second assembly pin.

10. A bolt for a firearm comprising a firing pin, the front part of which is of lesser diameter than its rear part to establish an intermediate shoulder and the rear part of which has a portion of reduced diameter, a bolt shell having a bore of reduced diameter in its forward portion and having a slot adjacent its front end and a cam shaped slot spaced rearwardly therefrom, an actuator and a tappet to be inserted into and slidably supported by said bolt shell, said actuator and said tappet each having an axial passage for said firing pin respectively of the diameter of the rear and front parts of said firing pin so that the rear face of said tappet constitutes a stop limiting the forward position of said firing pin, and a transverse bore intersecting said passage, the front portion of said tappet being of reduced diameter to enter the portion of the bore of said bolt shell

which is of reduced diameter, an assembly pin insertable through said first slot and through the transverse bore of said tappet, and a second assembly pin insertable through said cam shaped slot and through the transverse bore of said actuator, said assembly pins each having a transverse bore to receive said firing pin when alined with said passages, the transverse bore through said second assembly pin being of keyhole shape, the larger part of which registers with the passage in said actuator before said second pin is fully inserted to receive the rear end of said firing pin and the smaller part of which receives the portion of said firing pin which is of reduced diameter when said second assembly pin is fully inserted thereby to lock said pin, said portion of said firing pin which is of reduced diameter being of greater length than the diameter of said second assembly pin.

11. In a firearm for use with a cartridge having a centrally disposed primer, a receiver, a chambered barrel carried by said receiver, a bolt carried by said receiver to reciprocate between a cartridge seating position and an open position, said bolt and said chamber being proportioned to establish head space between said bolt and a seated cartridge when said bolt is in said cartridge seating position, said bolt comprising a bolt shell having a cartridge contacting face, an actuator slidable with reference to said bolt shell, and a

primer contacting tappet slidable with reference to said bolt shell and in engagement with said actuator when said bolt is in said cartridge seating position, means to lock said bolt shell against rearward movement when said bolt is in said cartridge seating position, means carried by said actuator to unlock said means, yieldable means urging said actuator forwardly and opposing its rearward movement, means connecting said actuator and said tappet to said bolt shell for movement relative thereto and to each other so that when said tappet is driven rearwardly by a primer, the rearward movement of said tappet relative to said bolt shell is limited, thereby limiting primer travel, and said actuator is driven rearwardly to effect the unlocking of said locking means and so that when said actuator is driven forwardly by said yieldable means, said bolt shell is carried into said cartridge seating position and in said cartridge seating position said actuator and said tappet are in engagement, and means carried by said tappet and engageable with said receiver when said bolt is in its cartridge seating position to position said tappet positively relative to said receiver and independently of said bolt shell thereby to prevent the front end of said tappet from protruding beyond the face of said bolt shell and to maintain it in predetermined relation to the head space.

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